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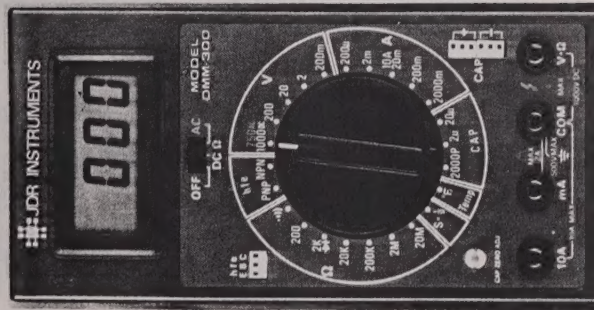
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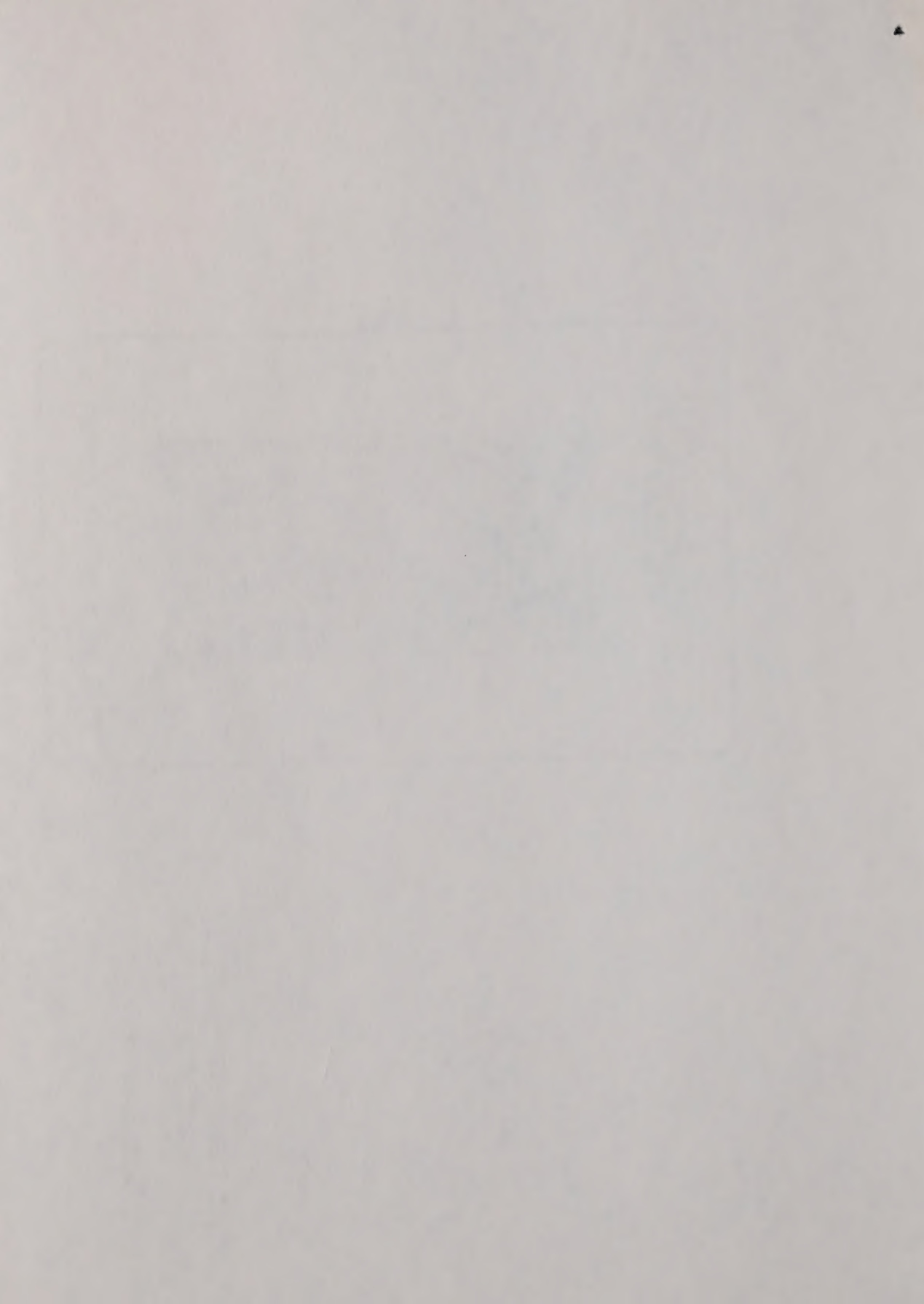
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DIGITAL MULTIMETER
MODEL DMM-300

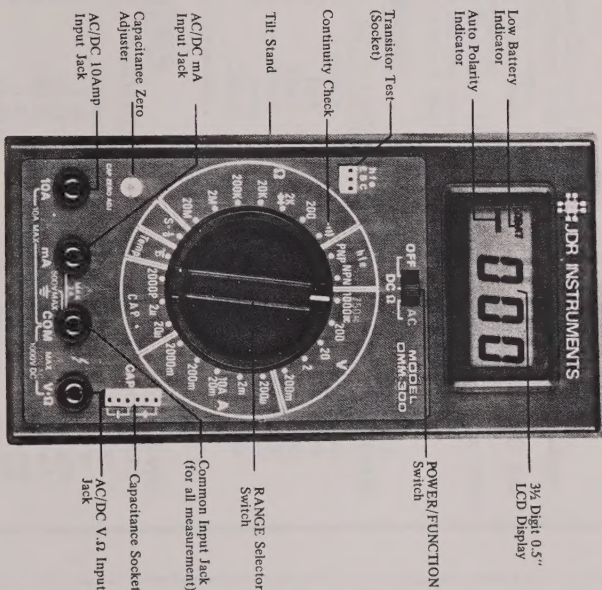
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JDR INSTRUMENTS



RELIABLE, ACCURATE MEASUREMENTS
0.25% BASIC DC ACCURACY, 10 AMP, AC/DC,
TEMPERATURE & CAPACITANCE MEASUREMENT
AMAZING QUALITY AT LOW COST!



SAFETY SYMBOLS

The symbol Δ on the instrument denotes that the user should refer to the operating instruction.
 The symbol ∇ on the instrument denotes that a high voltage may be present on the terminal(s).

MODEL DM-300 SPECIFICATIONS

GENERAL

DISPLAY : 3 1/2 digit LCD, 0.5" height, with polarity and LO BAT indication.
OVER RANGE INDICATION: 3 least significant digits blanked.
MAXIMUM COMMON MODE VOLTAGE : 500V peak.
OPERATING ENVIRONMENT: 0° to 50° C; less than 80% relative humidity up to 35° C, less than 70% relative humidity from 35° C to 50° C.
STORAGE ENVIRONMENT : -15° C to 50° C.
TEMPERATURE COEFFICIENT (0° to 18° C and 28° to 50° C): less than 0.1 % applicable accuracy specification per °C
POWER: 9V alkaline or carbon-zinc battery (NEDA 1604)
BATTERY LIFE : 100 hours typical with carbon-zinc cells 200 hours with alkaline cells.
BATTERY INDICATOR : Display indicates "LO BAT" when less than 20% of life remains.
DIMENSIONS' WEIGHT: 170mm X 87mm X 42mm, 382 grams.

DC VOLTAGE

RANGE	RESOLUTION	ACCURACY
200mV	100 μ V	
2V	1 mV	
20V	10 mV	$\pm (0.25 \% \text{ of reading} + 1 \text{ digit})$
200V	100 mV	
1000V	1 V	

Input Impedance : 10M on all ranges.
Normal Mode Noise Rejection: 46dB at 60HZ (1K unbalance)
Common Mode Noise Rejection: 100dB at 60HZ
Overload Protection: 1000V dc or peak on all ranges
Response Time : < 1 Sec.

DC CURRENT

RANGE	RESOLUTION	ACCURACY	MAX. F.S. VOLTAGE DROP
200 μ A	100nA	$\pm (0.5 \% \text{ rdg} + 1d)$	0.25V
2mA	1 μ A	$\pm (0.5 \% \text{ rdg} + 1d)$	0.25V
20mA	10 μ A	$\pm (0.5 \% \text{ rdg} + 1d)$	0.25V
200mA	100 μ A	$\pm (0.75 \% \text{ rdg} + 1d)$	0.25V
10A	1mA	$\pm (2 \% \text{ rdg} + 5d)$	0.75V
	10mA	$\pm (2 \% \text{ rdg} + 5d)$	0.30V

Overload Protection: mA Input: 2A/250V fuse
 10A Input: Unfused up to 15A for 15 seconds.

AC VOLTAGE

RANGE	RESOLUTION	ACCURACY	FREQ RANGE
200mV	100 μ V		
2V	1mV	$\pm (0.5\% \text{ rdg} + 5d)$	45Hz - 500Hz
20V	10mV	on all ranges	on all ranges
200V	100mV	$\pm (1\% \text{ rdg} + 5d)$	
750V	1V		

Conversion: Calibrated for rms of sine wave

Input Impedance: 10M shunted by 100pF on all ranges except

200mV range.

Common Mode Noise Rejection: 60dB, 50Hz - 60Hz (1 K Ω unbalance)

Overload Protection: 1000V dc or 750V rms ac continuous, except

15 sec max above 300V on 200mV range.

Response Time: 1 Sec.

AC CURRENT

RANGE	RESOLUTION	ACCURACY	MAX. F.S. VOLTAGE DROP
200 μ A	100nA	$\pm (0.75\% \text{ rdg} + 5d)$	0.25V rms
2mA	1 μ A	$\pm (0.75\% \text{ rdg} + 5d)$	0.25V rms
20mA	10 μ A	$\pm (0.75\% \text{ rdg} + 5d)$	0.25V rms
200mA	100 μ A	$\pm (0.75\% \text{ rdg} + 5d)$	0.25V rms
2000mA	1mA	$\pm (2\% \text{ rdg} + 5d)$	0.75V rms
10A	10mA	$\pm (2\% \text{ rdg} + 5d)$	0.30V rms

Overload Protection:

mA Input; 2A/250V fuse
10A Input; unfused up to 15A for 15 sec.

RESISTANCE

RANGE	RESOLUTION	ACCURACY	MAX. OPEN CIRCUIT V
200 Ω	100 m Ω	$\pm (0.5\% \text{ rdg} + 3d)$	2.8 V
2 K Ω	1 Ω	$\pm (0.3\% \text{ rdg} + 1d)$	2.8 V
20 K Ω	10 Ω	$\pm (0.3\% \text{ rdg} + 3d)$	500 mV
200 K Ω	100 Ω	$\pm (0.3\% \text{ rdg} + 3d)$	500 mV
2 M Ω	1 K Ω	$\pm (0.75\% \text{ rdg} + 5d)$	500 mV
20 M Ω	10 K Ω	$\pm (3\% \text{ rdg} + 5d)$	500 mV

Max allowable input: 500V dc or rms.

CONTINUITY TEST (•••)

Resistance range: Buzzer sounds at approximately less than

200 Ω

Response time: Less than 100 m Sec.

DIODE TEST (•••)

Test voltage: 2.8 Volts

Maximum test current: 3m Amperes

TEMPERATURE MEASUREMENT

RANGE	RESOLUTION	ACCURACY
-20°C to 1370°C	1°C	$\pm (3\% + 1d)$ up to 150°C
		$\pm 3\%$ of rdg over 150°C
0°F to 2000°F	1°F	$\pm (5\% + 2d)$ up to 225°F
		$\pm 3\%$ of rdg over 225°F

Sensor: Type K (NiCr-NiAl)

CONDUCTANCE MEASUREMENT

RANGE	RESOLUTION	ACCURACY
200 nS	0.1 nS	$\pm (1.5\% \text{ rdg} + 10 d)$

CAPACITANCE MEASUREMENT

RANGE	RESOLUTION	ACCURACY
2000 pF	1 pF	$\pm (1.5\% \text{ F.S.} + 5d)$
2 μ F	0.001 μ F	$\pm (2\% \text{ F.S.} + 5d)$
20 μ F	0.01 μ F	$\pm (2\% \text{ F.S.} + 5d)$

hFE TEST

Test condition: 10 μ A 2.8V

hFE gain 0 - 1000 (NPN, PNP)

FULLY OVERLOAD PROTECTED, UL 1244

Overload protection is accomplished on all ranges. For over voltage protection, a selected sparkgap with low capacitance is used which proved superior in performance than the varistors used other instruments. An intrush current limiter combination protects 500V dc or rms ac on all resistance ranges.

Also a pair of fast switching high current silicon diodes plus a fuse provide excellent protection on all current ranges.

Furthermore, the input of the A/D converter is protected against overvoltages.

SAFETY INPUT SOCKET AND PROTECTED TEST LEADS

The 4mm input sockets are fully recessed and protected against accidental contacts. The test leads supplied with the equipment give added safety to the user since the jacks are shrouded, thus avoiding dangerous connections to eventual high voltages. The prods supplied have finger stopper to keep fingers away from the naked end. The prod terminals are sufficiently long and slender to reach any test points found in actual boards.

OPERATOR SAFETY

Plastic ABS casing intrinsically insulated, deeply recessed socket, safety leads insure a large degree of protection on the user. Strong current cut-off power in case of accidental or erroneous connection to a power source will blow a fuse without damage to the operator or equipment (no arc in the fuse, no instrument burn-out).

OPERATING INSTRUCTIONS

GENERAL

The DMM 300 DMM is completely portable, pocket-sized 3-1/2 digit multimeter designed for use by the engineer, technician, and hobbyist who demand an instrument that is accurate, reliable and always ready for use. Equipped with nine functions and 34 ranges, each test position is quickly and easily selected with a simple turn of the single selector switch. Small enough to fit in attache cases and equipped with a multi-position tilt stand. This instrument is equally suited for design engineering, production testing, field servicing, and industrial maintenance applications.

WARNINGS

1. To avoid electrical shock hazard and/or damage to the instrument, do not measure voltages that might exceed 500V above earth ground.
2. Before the use of instrument, inspect test leads, connectors, and prods for cracks, breaks, or any defects in the insulation.

DC VOLTAGE MEASUREMENT

1. Connect red test lead to "V- Ω " input connector and black to "COM."
2. Slide the POWER/FUNCTION switch to "DC- Ω " (mid position).
3. Set RANGE switch to desired "V" position. If magnitude of value not only for this function but any measurement factor is not known, set switch to highest range and reduce until satisfactory reading is obtained.
4. Connect test leads to device or circuit being measured.
5. Turn on power to device or circuit being measured. Voltage value will appear on Digital Display along with the voltage polarity.

DC CURRENT MEASUREMENT

1. Red lead to "mA" jack for measurements up to 2Amps, Black lead to "COM" jack.

NOTE

For measurements between 2 Amps and 10 Amps, connect red lead to "10A" jack with fully depressed.

2. POWER/FUNCTION switch to "DC- Ω ", and RANGE switch to desired "A" position.
3. Open the circuit to be measured, and connect test leads IN SERIES with the load in which current is to be measured.
4. Read current value on Digital Display.

AC VOLTAGE MEASUREMENTS

1. Red lead to "V- Ω "; Black lead to "COM."
2. POWER/FUNCTION switch to "AC", and RANGE switch to desired "V" position.
3. Connect test leads to device or circuit being tested.
4. Read voltage value on Digital Display.

AC CURRENT MEASUREMENTS

1. Red lead to "mA" and Black lead to "COM" (For measurements between 2Amps and 10Amps, Red lead should be connected to "10A" jack).
2. POWER/FUNCTION switch to "AC", and RANGE switch to desired "A" position.
3. Open the circuit to be measured, and connect test leads IN SERIES with the load being measured.
4. Read current value on Digital Display.

RESISTANCE MEASUREMENTS

1. Red lead to "V- Ω ", Black lead to "COM."
2. POWER/FUNCTION switch to "DC- Ω ", and RANGE switch to desired "OHM" position.
3. If the resistance being measured is connected to a circuit, turn off power and discharge all capacitors before applying test prods.
4. Connect test leads to circuit being measured.
5. Read resistance value on Digital Display.

DIODE TESTS

1. Red lead to "V-Ω", Black lead to "COM".
2. POWER/FUNCTION switch to "DC-Ω", and RANGE switch to the 2KΩ (←) position.
3. If the semiconductor junction being measured is connected to a circuit, turn off power and discharge all capacitors.
4. Connect test leads to device.
5. In case of connection of forward (Red to anode, Black to cathode) a good diode shows a value. If the diode under test is defective, "000" (shorted), or "1" (open) is displayed. When the test leads are connected reverse (Red to cathode, Black to anode), a good diode shows "1". If it is defective, "000" or other figures are to be displayed.

CONTINUITY CHECKS

1. Red lead to "V-Ω", Black lead to "COM".
2. POWER/FUNCTION switch to "DC-Ω", and RANGE switch to Buzzer (•11) position.
3. Connect test leads to the circuit under test.
4. Built-in Buzzer sounds if the circuit under test is conducted.

TEMPERATURE MEASUREMENT

The meter can be used for making temperature measurements by connecting a thermocouple to "V-Ω", and "COM" jack proceed as follow:

1. Connect a type K (NiCr-NiAl) thermocouple to the jack on the instrument. See the accessories section for temperature probes and sensors.

CAUTION

Do not exceed 150V continuously or 300V momentary (no more than 10 seconds) to avoid any damage between the "V-Ω" and "COM" jack or instrument.

2. POWER/FUNCTION switch to "DC-Ω", and RANGE switch to "TEMP" position.
3. Place the probe or thermocouple tip on or in the material to be measured and take the temperature reading directly from the display. The reading is in °C (or °F).

NOTE

The meter is designed to show temperature automatically when a thermocouple is plugged into the jack, but the display will show "1" when no thermocouple is connected.

CONDUCTANCE MEASUREMENT

1. Red lead to "V-Ω", Black lead to "COM".
2. POWER/FUNCTION switch to "DC-Ω", and RANGE switch to "S = $\frac{1}{\Omega}$ ".
3. Connect test leads to the measuring point and read the value on Digital Display.

NOTE

1. A. S; SIMENS = $\frac{1}{\Omega}$ = international unit of conductance formerly known as the mho.
B. The readout is in terms of conductance with unit nS (10⁻⁹ S). If resistance reading are required, you can divide 1 by the readout, then multiply 10¹⁰.
2. Use conductance measurement as a leakage tester. The S measurement range effectively extends the resistance measurement capability of this DMM to the point up to 10,000M ohm where it can be used to provide useful leakage measurement on variable components, diodes, cables, connectors, printed circuit boards (pcb's), etc. In all cases the test voltage is < 5V DC.

$$\frac{1}{\text{Readout}} \times 10^{10} = \text{Resistance (ohm)}$$

For Examples,

If the measurement result is 10, the resistance reading is

$$\frac{1}{10} \times 10^{10} = 0.1 \times 10^{10} = 1,000M \text{ ohm}$$

If the measurement result is 1000

$$\begin{aligned} \frac{1}{1000} \times 10^{10} &= 0.001 \times 10^{10} \\ &= 10 \times 10^6 \text{ Ohm} \\ &= 10M \text{ ohm} \end{aligned}$$

CAPACITANCE MEASUREMENT

1. POWER/FUNCTION switch to "DC- Ω ", and Range switch to desired "CAP" position.
2. Before measurement, all capacitance ranges should be zero-setting. At an open condition or condenser is not connected CAP sockets, turn the "CAP ZERO ADJ" so that zero reading on display.
3. Insert the condensor to CAP sockets. (For measurement of polarized condensers, have the polarities of the CAP sockets, agree with those of a condenser.)
4. Read capacitance value on Digital Display.

hFE MEASUREMENT

1. POWER/FUNCTION switch to "DC- Ω ", and RANGE switch to "PNP" or "NPN" position according to type of transistor.
2. Insert pins of emitter, base, and collector of the transistor into E.B.C. pin socket respectively.
3. Read the displayed value of transistor gain (hFE) between 0 to 1000.

BATTERY REPLACEMENT

CAUTION

Before attempting battery removal or replacement, disconnect test leads from any energized circuits to avoid shock hazard.

1. It is necessary to replace battery when the words "LO BAT" appears in the upper left corner of the LCD screen.
2. Slide the battery cover upward by pressing it inward.
3. Unsnap the battery connector and replace with new 9 volt battery. For maximum life Alkaline cells are recommended although any standard 9 volt battery is suitable.
4. Place the battery cover in right position.

FUSE REPLACEMENT

1. This instrument is provided with a 2A/250V fuse to protect the current measuring circuits which measure up to 2000mA.
2. To replace the fuse, slide the battery cover upward by pressing it inward.
3. Replace blown fuse with new 2A/250V fuse. To prevent fire, do not use a fuse which has a higher rated value than specified.

CALIBRATION

1. GENERAL

- 1-1. Perform calibration at an ambient temperature of $25 \pm 2^\circ\text{C}$ and a relative humidity of 80% or less. Allow instrument to stabilize at this temperature for at least 30 minutes.
- 1-2. Remove the rear cover from the instrument by removing three screws and then lift off the cover.

2. DC CAL

- 2-1. Slide POWER/FUNCTION switch to "DC- Ω ", and the RANGE switch to 200mV position.
- 2-2. Set the output of the calibrator $190\text{mV} \pm 0.02\%$ and connect it to the "V- Ω ", and "COM" input connectors of the instrument.
- 2-3. Using a small flat-tipped screw driver, adjust potentiometer VR1 (DC, ADJ) until multimeter Digital Display reads exactly 190.0.
- 2-4. Remove the DC calibrator output from multimeter.

3. AC CAL

- 3-1. Slide POWER/FUNCTION switch to "AC".
- 3-2. Set the output of the AC calibrator for $190\text{mV} \pm 0.05\%$ pure sine wave at a frequency between 45 and 500HZ, and connect it to the "V- Ω " and "COM" input connectors of the multimeter.
- 3-3. Adjust potentiometer VR2 (AC, ADJ) until display reads exactly 190.0.

4. CAPACITANCE CAL

- 4-1. 2000 pF
Slide POWER / FUNCTION switch to "DC- Ω ", and RANGE switch to 2000p position. Turn the "CAP ZERO ADJ", so that zero reading on display. Insert 1000pF standard capacitor to CAP test sockets, and turn the VR3 so that 1000 reading on display.
- 4-2. 2 μF
Set the RANGE switch to 2 μ position, and turn the "CAP ZERO ADJ" so that zero reading on display. Insert 1 μF standard capacitor to CAP test sockets, and turn VR6 so that 1.000 reading on display.
- 4-3. 20 μF
Set the RANGE switch to 20 μ position, and turn the "CAP ZERO ADJ" so that zero reading on display. Insert 10 μF standard capacitor to CAP test socket, and turn the VR5 so that 10.00 reading on display.

5. **TEMPERATURE CAL**
Slide POWER/FUNCTION switch to "DC-Ω", and RANGE switch to Temp position. Set the output of the calibrator to DC 0.798mV $\pm$ 0.02% and connect it to the "V-Ω" and "COM" input connectors. Adjust VR7 until display reads exactly 20 + ambient temperature.
Ex, ambient temperature is 25°C.
 $20 + 25 = 45$

6. Set the rear cover to the instrument by tightening three screws.

CAUTION

The calibration procedures should be performed in regular sequence. Always DC voltage must be adjusted prior to AC voltage adjustment.

5. TEMPERATURE CAL
Slide POWER/FUNCTION switch to "DC-Ω", and RANGE switch to Temp position. Set the output of the calibrator to DC 0.798mV ± 0.02% and connect it to the "Y-Ω" and "COM" input connectors. Adjust VR7 until display reads exactly 20 + ambient temperature.
Ex, ambient temperature is 25°C.
 $20 + 25 = 45$

6. Set the rear cover to the instrument by tightening three screws.

CAUTION

The calibration procedures should be performed in regular sequence. Always DC voltage must be adjusted prior to AC voltage adjustment.

PARTS LIST

PART	DESCRIPTION	PART	DESCRIPTION
U1	A/D CONVERTER ICL 7106	R11	RESISTOR 2M $\frac{1}{4}$ W F METAL
U2	EX OR GATE CD 4070	R12, 13	RESISTOR 10K $\frac{1}{4}$ W F METAL
U3	OP AMP TL 061	R14	RESISTOR 4.5K $\frac{1}{4}$ W F METAL
U4	DUAL TIMER NE 555	R15	RESISTOR 1M $\frac{1}{4}$ W J CARBON
U5	OP AMP LM 308A	R16	RESISTOR 400K $\frac{1}{4}$ W F METAL
US1	CURRENT SOURCE LM 334	R17	RESISTOR 100K $\frac{1}{4}$ W F METAL
Q1, 2, 3, 5, 6	TR NPN SI 2N 3904	R18	RESISTOR 5K $\frac{1}{4}$ W J CARBON
Q4	TR NPN SI GES 5818	R19	RESISTOR 8.2K $\frac{1}{4}$ W F METAL
SG	SPARK GAP 1200V 20%	R20	RESISTOR 20K $\frac{1}{4}$ W F METAL
PT	CURRENT LIMITTER 1K 8mA 500V 20%	R21	RESISTOR 2.3K $\frac{1}{4}$ W F METAL
NE	NEON LAMP 80V	R22	RESISTOR 50K $\frac{1}{4}$ W F METAL
ZD1	ZENER DIODE 12V 1N 963	R23	RESISTOR 995K $\frac{1}{4}$ W F METAL
ZD2	ZENER DIODE 1.2V 1N 9491B	R24	RESISTOR 510 $\frac{1}{4}$ W F METAL
D1, 2	DIODE 50V 3A 1N 5400	R25	RESISTOR 230 $\frac{1}{4}$ W F METAL
D3-10	DIODE SI SWITCHING 1N 4148	R26	RESISTOR 3.3K $\frac{1}{4}$ W F METAL
C1, 2, 3	CAPACITOR 10 μ F 16V ELECTRIC	RS	SHUNT M ϕ 2 0.010hm WIRE
C4	CAPACITOR 1 μ F TANTAL 16V	VR1,2,5,6	SEMI VR 500 CET-091 TYPE
C5, 6	CAPACITOR 4.7 μ F TANTAL 16V	VR3, 7	SEMI VR 2.2K CET-092A TYPE
C6,7,11,12,13	CAPACITOR 0.1 μ F METALIZED 63V	RNA	RESISTOR NET WORK HC DMM-V
C8	CAPACITOR 0.022 μ F MICA 630V	RNB	RESISTOR NET WORK HC DMM-S
C9	CAPACITOR 0.047 μ F METALIZED 63V	RNC	RESISTOR NET WORK HC 501-C
C10, 22	CAPACITOR 0.22 μ F METALIZED 63V	RND	RESISTOR NET WORK HC 501-D
C14	CAPACITOR 100pF MICA 50V	RNE	RESISTOR NET WORK HC 5010-EC OR EF
C15, 17	CAPACITOR 0.01 μ F CERAMIC 50V	RNF	RESISTOR NET WORK RN 5010-ET1
C16	CAPACITOR 30pF CERAMIC 50V	RNG	RESISTOR NET WORK RN 5010-ET2
C18, 19, 28	CAPACITOR 0.022 μ F MYLAR 50V	BU1	OP AMP TL 061
C21, 26, 27	CAPACITOR 100pF CERAMIC 50V	BU2	QUAD NAND GATE CD 4011
C25	RESISTOR 100 $\frac{1}{4}$ W J CARBON	PBZ	PIEZO BUZZER 21 PA
R1	RESISTOR 910K $\frac{1}{4}$ W J CARBON	BD1	DIODE SI 1N 4148 OR 914
R2	RESISTOR 100 $\frac{1}{4}$ W C METAL	BVR1	SEMI VR 200K SR-085
R3	RESISTOR 10M $\frac{1}{4}$ W C METAL	BR1	RESISTOR 220K $\frac{1}{4}$ W J CARBON
R4	RESISTOR 900 $\frac{1}{4}$ W C METAL	BR2	RESISTOR 680K $\frac{1}{4}$ W J CARBON
R5	RESISTOR 0.09 $\frac{1}{4}$ W C WIRE	BR3-6	RESISTOR 1M $\frac{1}{4}$ W J CARBON
R6	RESISTOR 270 $\frac{1}{4}$ W F METAL	BR7	RESISTOR 1K $\frac{1}{4}$ W J CARBON
R7, 9	RESISTOR 180K $\frac{1}{4}$ W F METAL	BC1, 2	CAPACITOR 220pF CERAMIC 50V
R8	RESISTOR 2K $\frac{1}{4}$ W F METAL		
R10			

SCHEMATIC DIAGRAM

